

THE IMMATURE STAGES OF *PHANAEUS*  
(*COPROPHANAEUS*) *JASIOUS* OLIVER AND *PHANAEUS*  
(*METALLOPHANAEUS*) *SAPHIRINUS* STURM  
(COLEOPTERA: SCARABAEIDAE)

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This paper describes and gives observations on the biology of the larva and pupa of *Phanaeus* (*Coprophanaeus*) *jasius* Oliver and the larva of *Phanaeus* (*Metallophanaeus*) *saphirinus* Sturm, two common South American dung beetles. Following the classification of Janssens (1949), most workers currently place *Phanaeus* and related genera in the subtribe Phanaeina, one of four subtribes comprising the tribe Coprini (Scarabaeinae). The 150 or so species of Phanaeina are presently included in ten genera, by far the largest of which is *Phanaeus*<sup>2</sup>.

Phanaeines are restricted to the New World and principally to South America, though *Phanaeus* is well represented in Mexico and the United States. *Phanaeus jasius* is extremely widely distributed east of the Andes, occurring throughout the Amazon Basin southward to Bolivia and Paraguay. *P. saphirinus* is found from southern Brazil and northern Argentina westward into the Bolivian lowlands. As is generally the case for species of *Coprophanaeus* and *Metallophanaeus*, both species are necrophagous forest dwellers. They are very abundant locally during rainy seasons and are usually attracted to decaying flesh or, occasionally, to human or carnivore feces.

Laboratory work with these two species was conducted at the Departamento de Zoologia ("Museu Paulista"), Sao Paulo, Brazil. The following notes, based on rearing records, agree well with what is known in general about the biology of other phanaeines, as reviewed by Halffter and Matthews (1966). The primary purpose of this work was to obtain immatures; the unfortunate paucity of cooperating beetles precluded tampering with the rearing boxes to gain data on the nidification procedure and on other facets of dung beetle behavior.

The pear-shaped brood ball of *Phanaeus jasius* measured about 8 cm. high and 6 cm. through its greatest diameter. It consisted of a hard, spherical core about 3 cm. in diameter of very tightly packed carrion completely enclosed in an earthen cover about 1.5 to 2 cm. thick. That the food core was hard is indicated by the degree of mandibular wear in the larva (figs. 9 and 10). Even though the

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<sup>2</sup>The subgeneric classification of *Phanaeus* as used here and in current use is that established by G. d'Olsoufieff (1924). Tentative results of my current research on the supraspecific systematics of the Phanaeina support the division of *Phanaeus* (*sensu* d'Olsoufieff) into two distinct genera, namely *Phanaeus* (to include the subgenera *Phanaeus*, *s. str.*, and *Sulcophanaeus*) and *Coprophanaeus* (including *Coprophanaeus*, *Megaphanaeus* and *Metallophanaeus*).

surrounding soil was very moist, all brood balls observed were exceptionally dry within, particularly the food core. An egg chamber was located dorsal to the food core and separated from it by a thin earthen partition. The enormous, cylindrical eggs of *jasius* were approximately 5 mm. x 10 mm. (For comparison, the length of an average adult female is roughly 30 mm.) The single larva allowed to pupate had completely consumed the food core and plastered and smoothed the wall of the resulting cavity with, presumably, the "anal paste" characteristically exuded by disturbed larvae. The pupa reposed on its back in its spherical cavity. No striking modifications of the dorsal end of the brood ball, such as those fashioned by the larva of a closely related species, *P. (C.) milon* (Blanch.) (Barrattini and Sáenz, 1953), were observed made by the larva of *P. jasius*. The brood balls of *P. saphirinus* were similar to those of *jasius* but smaller (about 6.5 x 5 cm.); other details were not observed.

A female of *P. jasius* was confined with two males on 29 December, 1965, and two third instar larvae and one pupa were recovered on 22 March, 1966. Both *jasius* larvae carried mite deutonymphs (Acaridei: Anoetidae) on the prothoracic shields and procoxae. A female of *P. saphirinus* was confined alone on 8 January, 1966, and two third instar larvae were collected on 22 March, 1966. These meager data imply an egg-to-pupa developmental time of about 90 days. Even though male-female cooperation in nidification is known to occur in *Phanaeus* (Halffter and Matthews, 1966: 160), the solitary confinement of a presumably already fertilized female *saphirinus* which produced young indicates that the male is not an absolutely necessary partner for nidification in this species.

#### METHODS

The immatures described here were reared using the procedure of Lindquist (1935). Adults of *Phanaeus jasius* were collected in "meat traps," cans buried to their rims and baited with rotting meat. Field collected adults were confined in large (50 x 50 x 50 cm) screen covered wooden boxes containing tightly packed moist soil. Both *jasius* and *saphirinus* were provided and readily accepted scraps of raw meat; cow dung was refused by both species, even if it was the only potential food available. After about a month the boxes were opened and searched for brood balls, which in turn were checked for eggs or developing larvae. This procedure yielded six complete brood balls from two female *jasius* (confined with two males), four of which contained larvae, one an inviable egg and the other only the food core. Likewise, a single female *saphirinus* yielded two brood balls, both containing larvae.

Similar rearing procedures were unsuccessful for the following phanaeines collected in Manaus, Amazonas (March, 1966), probably because of the adverse climate of Sao Paulo and overcrowding: *Phanaeus (Megaphanaeus) lancifer* (L.), *P. (Coprophanaeus) dardanus* MacLeay, and *Diabroctis (= Taurocopris) mimas* (L.).

Larvae and pupa were killed in boiling water, injected with Dietrich's solution and preserved in 70% ethanol.

The descriptions are based on the following material: *Phanaeus (Coprophanaeus) jasius* Oliver—two third instar larvae, one cast integument of third instar larva and one pupa, siblings from female collected in meat trap on 16 November, 1965, at Fazenda Barriero Rico (a ranch), 5 km. N. Anhembi, Sao Paulo, Brasil (W. D. Edmonds, col.). *P. (Metallophanaeus) saphirinus* Sturm—two third instar larvae, siblings from female collected on human feces, January

1966, at Nova Friburgo, Rio de Janeiro, Brasil (J. H. Guimaraes, col.).

The terminology used in the descriptions of larvae is largely that used by Ritcher (1966 and elsewhere) and other American workers. Following is a list of abbreviations used in the figures and parenthetically in the descriptions:

aa	—seta of the anterior angle of the frons	ma	—mandibular acetabulum
abp	—abdominal projections of the pupa	mc	—mandibular condyle
afs	—anterior frontal setae	md	—mandible
an	—anal slit	mep	—mesothoracic projection of pupa
ant	—antenna	mp	—maxillary palpus
ap	—anterior process of the prothoracic shield	mtp	—metathoracic projection of pupa
br	—brustia	mx	—maxilla
C	—clypeus	o	—onculus (=hypopharyngeal sclerite)
car	—cardo	pe	—pedium
cpa	—chaetoparia	pfs	—posterior frontal setae
des	—dorsoepicranial setae	ph	—phobae
dms	—dorsomolar setae	pp	—pronotal prominence of pupa
E	—epicranium	ps	—prothoracic shield
ecs	—exterior clypeal setae	Pthx	—prothorax
ep	—elytral pad	ptt	—pternotorma
eps	—epicranial suture	S <sub>1-3</sub>	—scissorial teeth of mandible
F	—frons	se	—sensory spot
fs	—frontal suture	st	—stipes
ga	—galea	str	—stridulatory teeth of stipes
gl	—glossa	t	—torma
L	—labrum	tib	—tibia of foreleg of pupa
lac	—lacinia	ts	—tarsal sheath
lb	—labium	tsp	—tibial spur
les	—lateral epicranial setae	ung	—uncus of galea
lms	—lateral mandibular setae	unl	—uncus of lacinia
lp	—labial palpus	vms	—ventromolar seta tuft
m	—molar lobe of mandible	wp	—hind wing pad

## DESCRIPTIONS

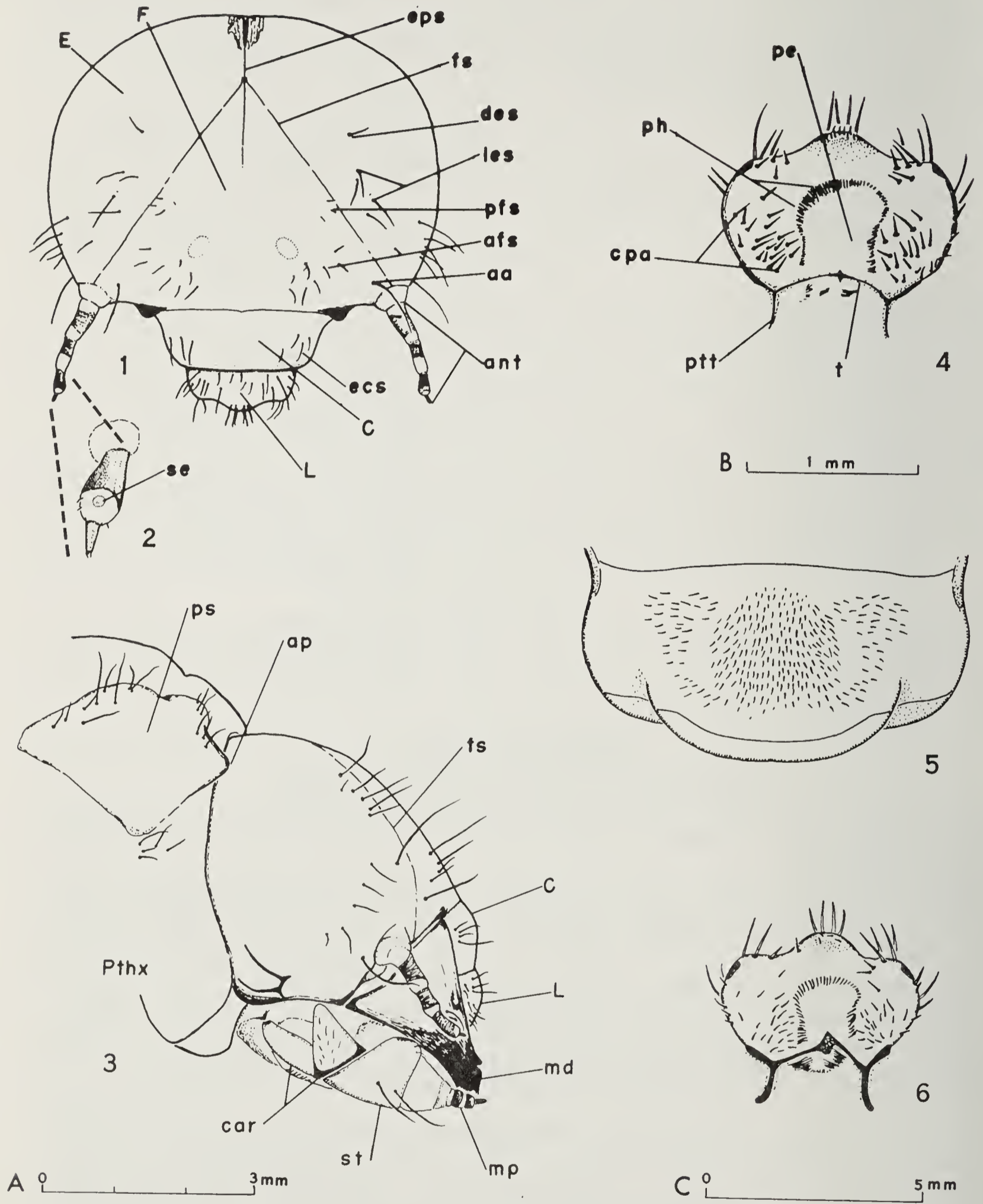
### *Phanaeus (Coproghanaeus) jasius* Oliver

Third instar larva (Figs. 1-5, 7-11, 15, 16)

**GENERAL:** Body C-shaped, "humped" dorsally, flattened caudally; total dorsal length 5.5-6.5 cm.

**HEAD CAPSULE.** (figs. 1, 3): Flattened anteriorly, rounded laterally, maximum width 5.5-5.8 mm.; epicranial suture (eps) widened dorsally, extended anteriorly beyond juncture of frontal sutures; frontal sutures (fs) straight. Epicranium (E) and frons (F) straw-colored. Cranial setae on each side as follows: dorsoepicranial setae (des) single or paired; 4 or 5 loosely grouped lateral epicranial setae (les); 3 small posterior frontal setae (pfs); irregular groups of 8 to 10 anterior frontal setae (afs); one seta (aa) in anterior angle of frons. *Clypeus* (C) straw-colored except narrow lighter distal margin; each side with three exterior clypeal setae (ecs). *Labrum* symmetrical, weakly trilobed, median lobe with 8 marginal setae, exposed surface with randomly scattered setae. Epipharyngeal surface of labrum (fig. 4): chaetopariae (cpa) each with 15 to 20 stout, prostrate setae; pedium (pe) bare, bulging on left side; phobae (ph) forming asymmetrical loop of prostrate setae, appearing erect on left because of bulge of pedium; mesophoba reduced to irregular clusters of fine hair-like setae behind united tormae; tormae (t) very narrow, united mesally, each with narrow pternotorma (ptt); epitormae reduced. No haptomerum or macrosensillae observed.

**HEAD APPENDAGES:** *Antennae* (ant) four-segmented (figs. 1, 3), basal two



FIGURES 1-6. *Phanaeus (C.) jasius* Oliv., larva. 1—Head, anterior view (mandibles removed). 2—Third and fourth segments of right antenna, inner surface view. 3—Head and portion of prothorax, lateral view. 4—Epipharyngeal surface of labrum. 5—Venter of tenth abdominal segment. Figure 6. *Phanaeus (M.) saphirinus* Sturm, larva. Epipharyngeal surface of labrum. Scale A—figs. 1, 3; B—4, 6; C—5.

segments nearly fused, distal segment much reduced; third segment with round sensory spot (se) on inner side near apex (fig. 2). *Mandibles* (md) (figs. 8-10): left mandible with three separated scissorial teeth ( $S_{1-3}$ ); right mandible with first and second teeth fused, separated from third by small notch. Dorsomolar setae (dms) of both mandibles arranged in oblique row; left mola (m) concave; right mola flattened, with prominent tooth directed mesally from anterior margin and with fringe of very short stiff setae along outer side of apex; brustia (br) of left mola of many setae, that of right mola reduced to single small tuft; tuft of ventromolar setae (vms) present on both mandibles; scrobis of both mandibles represented by one long lateral mandibular seta (lms). *Maxillae* (figs. 3, 7): cardo (car) distinctly tripartite; stipes (st) with 14 or 15 stridulatory teeth (str) in irregular row; uncus of lacinia (unl) strongly developed, without basal tooth; uncus of galea (ung) a small apical sclerotized pad; palpus (mp) four-segmented, basal segment very weakly sclerotized, distal segment with apical sensory spot. Setation of maxilla as in figure 7. *Labium* (fig. 11): oncyclus (o) (= hypopharyngeal sclerite) of two irregular plates; glossa (gl) bounded posteriorly by transverse row of many very short setae; palpus (lp) two-segmented, distal segment with apical sensory spot.

**THORAX:** Prothoracic shields (ps) present, with prominent anterior angle (ap) (fig. 3); thoracic spiracular plate twice size of abdominal spiracular plates. Legs two-segmented, apex of each (fig. 15) with two long setae surrounded by 12 to 14 short, spine-like setae.

**ABDOMEN:** third tergum without projecting "wart"; each tergum with transverse polystichous row of sparsely set setae, otherwise bare. Setation of venter of tenth segment as in figure 5. Anal slit (an) transverse, surrounded by prominent lobes (fig. 16).

#### Pupa (Figs. 12-14)

Matthews (1963) noted the lack of any taxonomic basis for the description of scarab pupae. Since this is still the case, description of the pupa will be limited to the illustrations and mention of the following features:

a. Pupal support projections are present as follows (fig. 14): two rather large, closely set, flattened lobes (pp) near middle of anterior margin of pronotum; a small, papillar protuberance (mep) near posterior margin of mesonotum; a finger-like, recumbent lobe (mtp) originating near posterior margin of metanotum; short, lobe-like projections (abp) from each side of abdominal terga 2-6, varying somewhat in size and shape. (Indistinct projections also occur on tergum 7.) In addition, large swellings on the base of the elytral pads are apparently support points.

b. Abdominal terga 1-6 each bearing a pair of spiracles; atria of first three pairs project beyond the body wall. Spiracles on tergum 7 are absent or concealed in folds of the integument. (Adults have seven distinct pairs of spiracles.)

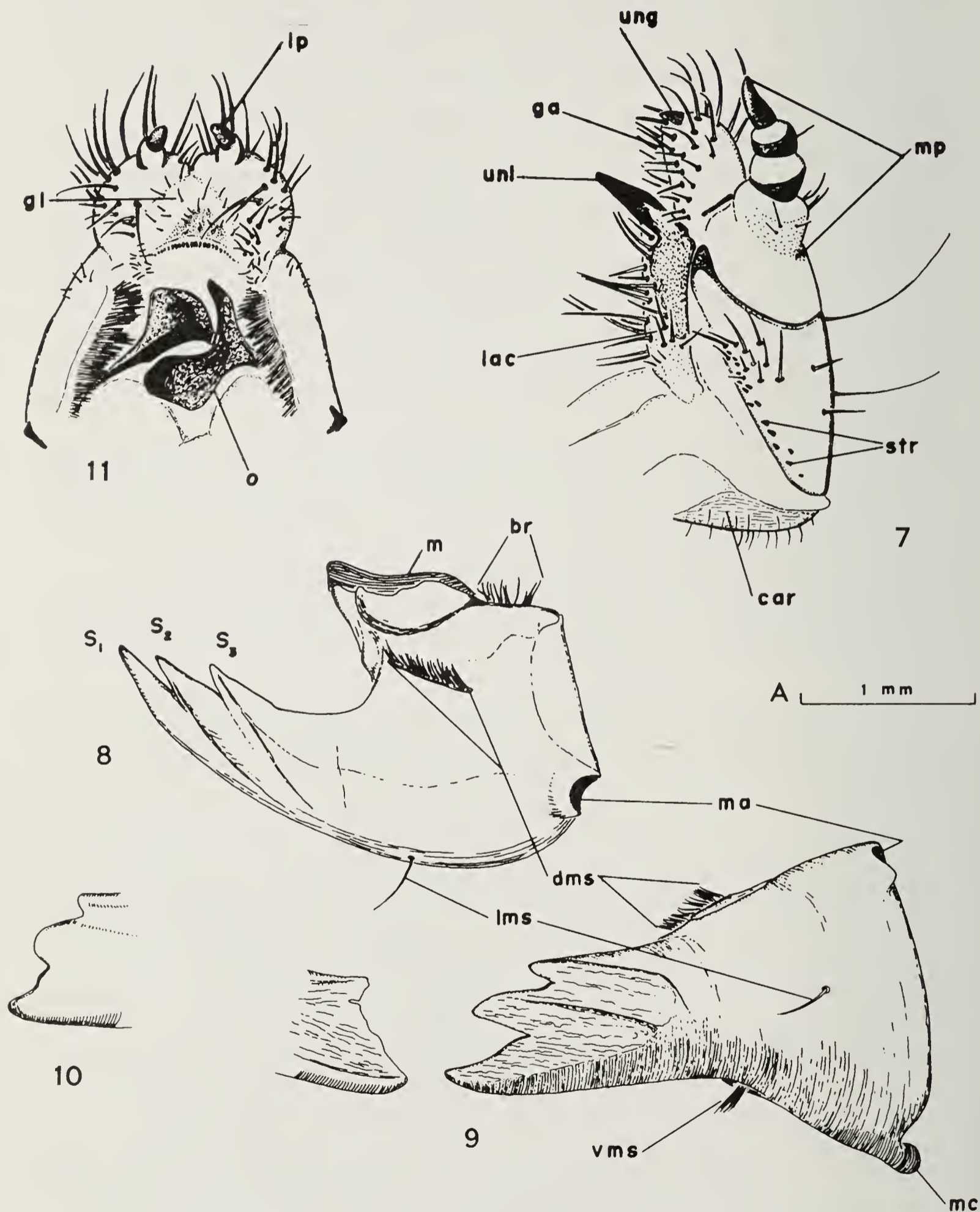
c. The apex of the foretibiae (figs. 12, 13), at the base of the developing tibial spur (tsp), bears a hollow, indistinctly segmented integumental evagination (ts) apparently representing a tarsal sheath which contains no developing tarsus.

The structure of the cephalic process, apparent lack of a developing genital capsule and presence of tarsal sheaths indicate that this pupa contains a developing female. Total body length—30 mm.

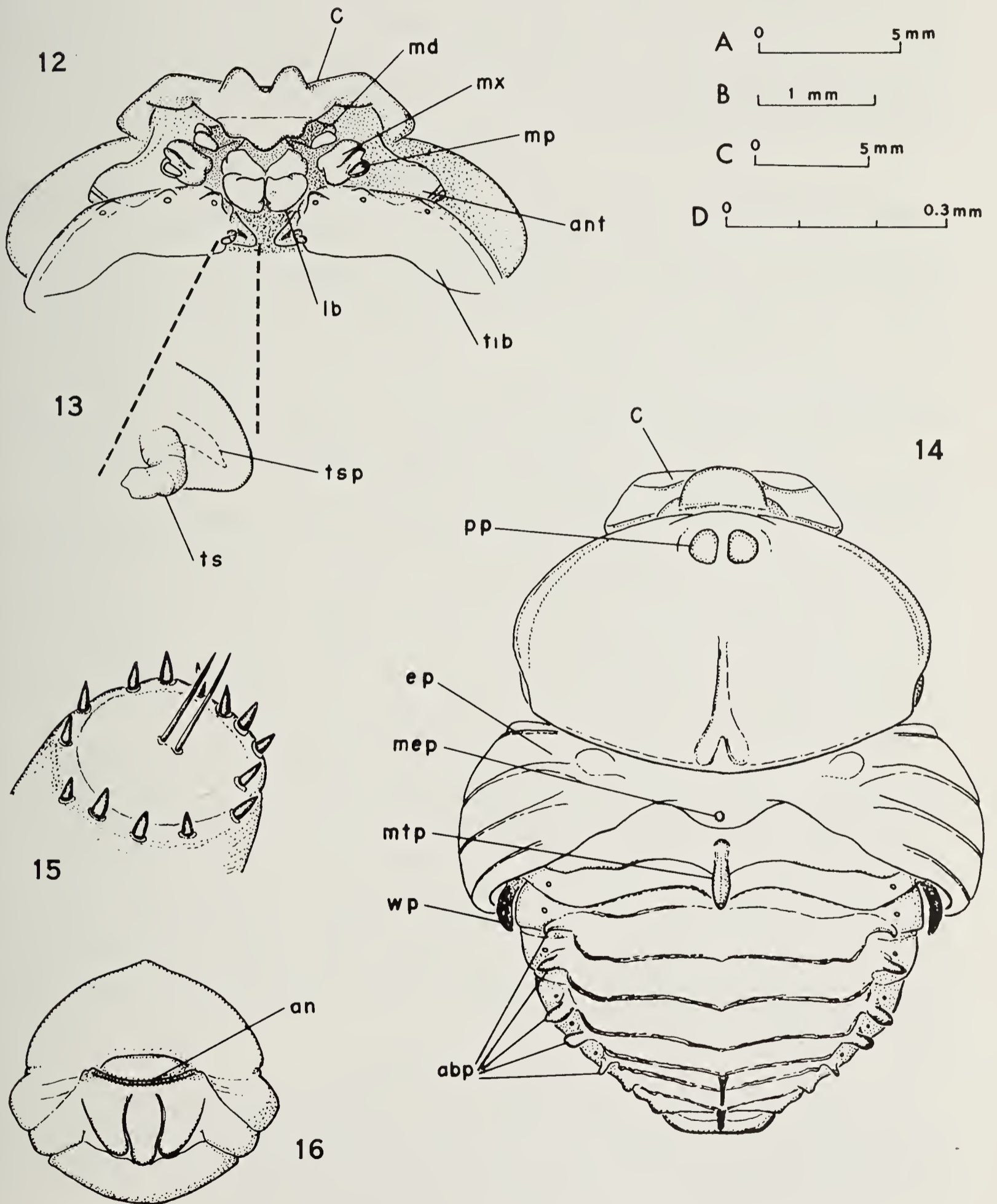
*Phanaeus (Metallophanaeus) saphirinus* Sturm

Third instar larva (Fig. 6)

Because of their great similarity, description of the larva of *Phanaeus saphir-*



FIGURES 7-11. *Phanaeus (C.) jasius* Oliv., larva. 7—Maxilla, anterior view. 8—Left mandible, anterior view. 9—Left mandible and scissorial area of right mandible, lateral view. 10—Worn scissorial area of left mandible of cast integument. 11—Labium, anterior view. Scale A—figs. 7-11.



FIGURES 12-16. Larva and pupa of *Phanaeus (C.) jasius* Oliv. 12—Anterior end of pupa, ventral view. 13—Tip of right foreleg of pupa, ventral view. 14—Dorsal aspect of pupa. 15—Tip of metathoracic leg of larva. 16—Anal area of larva, caudal view. Scale A—figs. 12, 16; B—13; C—14; D—15.

*inus* will be limited to mention of those features observed to differ from their counterparts in *P. jasius*.

**GENERAL:** Total dorsal length 4.5-5.2 cm.

**HEAD CAPSULE:** Maximum width 4.6-4.8 mm; dorsal and lateral epicranial setae together forming a loose group of 4 or 5 setae; one short posterior frontal seta; two irregular groups of 5 or 6 anterior frontal setae; each anterior angle of frons with two unequal setae; 4 or 5 exterior clypeal setae per side. Epipharyngeal surface of labrum (fig. 6): chaetopariae each with 20 to 23 setae; mesophoba reduced but less so than in *jasius*; tormae united asymmetrically. **HEAD APPENDAGES:** Maxillae:stipes with 9 or 10 stridulatory teeth; uncus of lacinia with two very small basal teeth.

#### COMMENTS

To my knowledge only one other phanaeine larva has been described well enough for present comparative purposes, that of *Phanaeus (P.) vindex* MacLeay (Ritcher 1945, 1966). The notes given by Judulien (1899) on the larvae of some Argentine dung beetles, including several phanaeines, need confirmation. Ohaus' description (1913) of the larva (and pupa) of *Phanaeus floriger* Kirby (= *P. (P.) splendidulus* (Fab.)) is only detailed enough to indicate the general resemblance of *floriger* to the larvae described here. Besides these phanaeines, larvae of only a few other Coprini have been adequately described: *Ateuchus heteroides* Web., *Dichotomius carolinus* (L.) (as *Pinotus*), *Copris minutus* (Drury) and *C. fricator* (Fab.) by Ritcher (1945, 1966); *Copris lunaris* (L.) and *Synapsis tmolus* (Fischer) by Medvedev (1952).

The larvae of *Phanaeus jasius* and *P. saphirinus* differ in the following features from the larva of *P. vindex*, as described and figured by Ritcher: 1) straight frontal sutures, 2) reduced epitormae, 3) reduced mesophoba, 4) number of setae of chaetoparia and 5) legs each with two long, terminal setae. *P. saphirinus* differs further by having two setae on each anterior angle of the frons. Except for reduction of the mesophoba, these two species agree with Ritcher's (1966) characterization of the larvae of Scarabaeinae; but character 5 above will misplace them in his key (p. 14) to known scarabaeine genera.

Very few accounts have appeared of the pupae of Coprini. Halffter and Matthews (1966: 186) offer some comparative data on the support projections of the pupae of species of *Copris*, and Ohaus (1913) mentions those borne by the pupa of *Phanaeus floriger*. Except for possible differences in the pronotum, the pupal support projections of *P. jasius* correspond exactly with those of *P. floriger*. The presence on the pupa of *jasius* of front tarsal sheaths is noteworthy. No known adult male phanaeines have front tarsi; they are characteristically absent in the females of several groups, including the subgenus *Coprophanaeus*. The tarsal sheaths thus represent a clear case of pupal retention of a character lost in the adult.

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